



# FACTS

ABOUT THE SAVANNAH RIVER SITE

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## Liquid Radioactive Waste Processing Facilities

Radioactive liquid waste is generated at the Savannah River Site (SRS) as by-products from the processing of nuclear materials for national defense, research and medical programs. The waste, totaling about 36 million gallons, is currently stored in 49 underground carbon-steel waste tanks grouped into two “tank farms” at SRS.

There are four types of waste tanks:

### Type I Tanks

- 12 Type I tanks were built 1952-53
- 750,000 gallon capacity, 75 feet in diameter by 24-1/2 feet high
- Partial secondary containment and leak detection system
- Contain approximately 12 percent of the site’s waste volume
- Seven Type I tanks have leaked waste into the tank annulus (secondary containment); waste stored in these tanks is now below the known leak sites.

### Type II Tanks

- 4 Type II tanks were built 1955-56
- 1,030,000 gallon capacity, 85 feet in diameter by 27 feet high
- Partial secondary containment and leak detection system
- Contain approximately 4 percent of the site’s waste volume
- The four Type II tanks have leaked waste into the tank annulus; waste stored in these tanks is now below the known leak sites.

### Type III Tanks

- 27 Type III tanks were built 1967-81
- 1.3 million gallon capacity, 85 feet in diameter by 33 feet high
- State-of-the-art design, including heat stress relief of the tank walls to prevent cracking
- Full height secondary containment and leak detection system
- Contain approximately 77 percent of the site’s waste volume
- No Type III tanks have leaked waste.

### Type IV Tanks

- 8 Type IV tanks were built 1958-62 (two of the eight tanks were certified closed after being filled with grout and cement)
- 1.3 million gallon capacity, 85 feet in diameter by 34 feet high

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- No secondary containment
- No active leak detection system
- Contain approximately 7 percent of the site's waste volume
- One Type IV tank has had groundwater in-leakage, but that tank is now empty.

The top cleanup priority at SRS is to remove, stabilize, and dispose of the radioactive waste in waste tanks and close the waste tanks.

## Evaporators

While the waste is stored in the tanks, it separates into two parts: a sludge that settles on the bottom of the tank and a liquid supernate that resides on top of the sludge. The liquid waste is reduced to less than 30 percent of its original volume by evaporation. The evaporator "overheads," water removed from the waste, are transferred to the Effluent Treatment Project for final cleaning prior to release to the environment. As the remaining concentrated waste cools, a portion of it crystallizes, forming solid saltcake. Reducing the waste volume creates tank space to support SRS operations. Also, the concentrated supernate and saltcake are less mobile and therefore less likely to escape to the environment in the event of a tank crack or leak.

SRS currently has three operational evaporators:

### 2F Evaporator, located in F Area

- Single-stage, bent tube design
- Began operating in 1980
- Volume-reduces waste from H Canyon and processes sludge-bath decants

### 2H Evaporator, located in H Area

- Single-stage, bent tube design
- Began operating in 1982
- Only evaporator qualified to process recycle material from DWPF due to high silica concentrations

### 3H Evaporator, located in H Area

- Single-stage, bent tube design
- Began operating in 2000
- Largest capacity evaporator (about twice that of 2F or 2H Evaporator)
- Processes sludge-batch decants and further reduces "liquor" from 2F Evaporator and H-Canyon waste as needed

Two other evaporators have previously operated on site, but SRS does not plan to use them in the future.

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## Effluent Treatment Project

The Effluent Treatment Project, located in H Area, treats the low-level radioactive wastewater that was formerly sent to seepage basins. Treated streams include evaporator overheads, segregated cooling water, contaminated surface water runoff, transfer-line catch tank streams and others.

- Began operating in 1988
- Processes approximately 20 million gallons of wastewater per year
- Treatment processes include pH adjustment, filtration, organic removal, reverse osmosis and ion exchange.
- Treated waste water streams are released to a permitted outfall.

## Waste Removal

Sludge and saltcake must be removed from the storage tanks to be processed for ultimate disposal so that the tanks can be either reused or retired, as appropriate. This process is ongoing.

- Sludge waste is removed by installing slurry pumps and adding water. The slurry pumps suspend the sludge in the water so that the mixture can be transferred to the Extended Sludge Processing Facility.
- Saltcake waste is removed by adding water and, if warranted, mixing pumps. The water dissolves the saltcake before the material is transferred to a salt processing facility.

## Extended Sludge Processing Facility

The Extended Sludge Processing Facility washes the sludge to remove excess soluble salts before the sludge is ready to feed to the Defense Waste Processing Facility.

- Process includes washing to remove dissolved salts, gravity settling, and decanting the salt solution.
- Slurry pumps provide agitation of the sludge during washing.
- Wash water is either treated through evaporation or recycled and used to dissolve saltcake.

## Defense Waste Processing Facility

DWPF, located in S Area, immobilizes the radioactive waste sludge by vitrifying it into a solid glass waste form.

- The sludge and borosilicate glass "frit" are mixed together to form melter feed.
- The sludge/precipitate/glass mixture is fed to a melter and heated to approximately 2,100 degrees F (1,150 degrees C).
- The molten glass is poured into stainless steel canisters to cool and harden.
- Each canister is 10 feet tall and 2 feet in diameter.
- The glass canisters are sealed, decontaminated, welded shut and then stored on site in a building designed for safe interim storage until a federal repository is available.
- DWPF began processing radioactive sludge in March 1996.

## Salt Waste Processing

In September 2001, a National Environmental Policy Act (NEPA) Record of Decision (ROD) selected the caustic side solvent extraction (CSSX) technology as the basis for the design and construction of a Salt

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Waste Processing Facility (SWPF). The SWPF is currently in the design phase. The start of radioactive operations is planned for FY 2011.

### **Interim Salt Processing**

Due to a shortage of Type III tank space, some salt waste disposition is necessary before the start-up of the SWPF to ensure sufficient tank space for continued sludge washing and sufficient tank space for the initial salt processing by the SWPF. Only limited quantities of salt waste will be processed in this manner. In order to accomplish this, the following activities are currently planned.

- **Deliquification, Dissolution, and Adjustment (DDA)**

For salt in selected tanks that are relatively low in radioactive content, deliquification (i.e., extracting the interstitial liquid from the saltcake) is sufficient to produce a salt that meets the Waste Acceptance Criteria (WAC) of the Saltstone Disposal Facility (SDF). Deliquification is an effective decontamination process because the primary radionuclide in salt is Cesium-137 (Cs-137), which is highly soluble. Exploiting the solubility of Cs-137 and isolating the insoluble fraction produces a low-level waste stream. The saltcake is then dissolved with water or DWPF recycle and transferred to the Saltstone Processing Facility for treatment and disposal.

- **Actinide Removal Process (ARP)**

Even though extraction of the interstitial liquid reduces Cs-137 and soluble actinide concentrations, the Cs-137 or actinide concentrations of the resulting salt in some tanks are too high to meet the SDF WAC. Salt from these tanks first will be sent to ARP. In ARP, monosodium titanate (MST) is added to the waste, and actinides are sorbed on the MST and then filtered out of the liquid to produce a low-level waste stream that is sent to MCU. If the soluble actinides in the original salt solution are sufficiently low, then the stream will not require the MST strike and will only be filtered prior to being sent to the MCU. After SWPF startup, ARP will send clarified salt solution to SWPF for cesium removal.

- **Modular CSSX Unit (MCU)**

For tanks with salt that is too high in activity for deliquification to sufficiently reduce Cs-137 concentrations, the salt in these tanks must be further treated to reduce the concentration of Cs-137 using the CSSX process. The process will be the same as that used in the SWPF. Salt to be processed will first be processed through ARP and then through the modular unit. This unit will allow processing of salt waste with higher Cs-137 concentrations at a relatively low rate. The cesium solution will be transferred to the DWPF for incorporation into glass and the decontaminated salt waste will be transferred to the Saltstone Processing Facility for final treatment and disposal in above-ground vaults. The MCU will cease operations when the SWPF begins operations in about FY 2011.

## **Salt Waste Processing Facility**

- This is the full-scale CSSX process. The facility incorporates both the ARP and CSSX process in a full-scale shielded facility capable of handling salt with high levels of radioactivity. After startup of SWPF in approximately 2011, all remaining salt waste will be processed through this facility.

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## Saltstone Facility

The Saltstone Processing Facility, which has operated intermittently since 1990, treats and permanently disposes of low-level liquid waste by stabilizing it in a solid, cement-based waste form.

- Liquid waste is combined with a dry blend of cement, slag and flyash.
- The resulting mixture is referred to as “Saltstone grout.”
- The grout is pumped to above-ground engineered vaults, where it solidifies into “saltstone.”
- Saltstone is a non-hazardous waste form.

This facility is has been modified to accommodate higher radioactivity levels in support of the interim salt processing strategy. Additional vaults beyond the 2 existing ones will be constructed as needed to receive and store the treated salt waste as it is processed.

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